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EXAMINER

WANG, EUGENIA

ART UNIT

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/530,002	UENSAL ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	EUGENIA WANG	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 December 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☐ Claim(s) 29-46 and 48-58 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 29-46 and 48-58 is/are rejected.
- 7) ☒ Claim(s) 36 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. In response to the amendment received December 14, 2007:
  - a. Claim 47 has been cancelled per Applicant's request. Claims 29-46 and 48-58 are pending.
  - b. The previous 112 rejection has been withdrawn in light of the amendment.
  - c. The double patenting rejection with respect to copending Application 10/529993 has been withdrawn, as a terminal disclaimer has been filed in the aforementioned copending application.
  - d. The previous rejection of record has been withdrawn. However, a new rejection similar to the one made in the Office Action mailed October 17, 2006 has been made in light of an evidentiary piece. Examiner will address the pertinent arguments with respect to the rejection as set forth in the arguments filed on April 17, 2007 in the body of the rejection. Any changes in the rejection are proper in light of the filing of the request for continued examination.

### ***Continued Examination Under 37 CFR 1.114***

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 14, 2007 has been entered.

***Claim Objections***

3. Claim 36 objected to because of the following informalities: it lists "dihydroxyisophthalic aid" in line 6, wherein Examiner believes "aid" should be replaced with 'acid'. Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second para of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 29, 30, 32, 34, 35, 37, 38, 44-46, 48-58 are rejected under 35 U.S.C. 112, second para, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 29, 54, and 57 use "derivatives" of carboxylic acids (see step A). However, the term "derivatives" is indefinite since it is unclear as to what derivatives (all or some) were appreciated by the instant claimed invention. Claims 30, 32, 34, 35, 37, 38, 44-46, 48-53, 55, 56, and 58 are rejected for the same reason, as they are dependent on one of claims 29, 54, or 57 and do not rectify the problem.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 29-34, 36, 41-43, 48-50, and 52-58 are rejected under 35 U.S.C. 102(b) as being anticipated by WO 02/38650 (Sakaguchi et al.) as evidenced by

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“Polyphosphoric Acid Assay” (Innophos). (Note: US 2004/0062969 is being relied upon as the English translation of WO 02/38650.)

Regarding claims 29, 54, 56, and 57 Sakaguchi et al. teaches a path for synthesizing a polybenzazole compound having a phosphono group to be used as electrolyte film for a fuel cell. The path begins with selecting a compound out of a first grouping, the listed group including aromatic tetraamines, and a second compound out of a group consisting of aromatic dicarboxylic acid and their derivatives (para 0091). Additionally, the aromatic dicarboxylic acids can have a phosphonic acid group (para 0092, lines 1-4). The polybenzazole compound having the phosphonic acid group can be synthesized with the two aforementioned precursors by dehydration and cycling polymerization with a solvent of polyphosphoric acid (para 0110, lines 1-11). Afterwards the polybenzazole compound having the phosphonic acid group is added to a resin, which is later cast on a glass or Teflon plate (para 206, lines 1-5; para 0207, lines 6-8). (Note: the aforementioned chemicals used in polymer creation are ones listed in step A) of claims 29, 54, and 57, while the glass/Teflon plate provides the support for the mixture, as denoted in step C) or E) of claims 29, 54, and 57). The inventive polymer is then solidified and can be used as a membrane (para 0210). Additionally, the composition containing the inventive polybenzazole compound having the phosphonic acid group can be used in a fuel cell assembly, where the solid polymer and electrode catalytic layers are bonded to both surfaces thereof as a component of the solid polymer electrolyte membrane/electrode assembly (as applied to claims 54, 56, and 57) (para 0214). Methods of forming the electrolyte membrane/electrode assembly include

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hot-pressing with a catalytic metal and a binder, spraying the polymer electrolyte with the inventive polybenzazole compound with the sulfonic/phosphonic acid group to a gas-diffusion electrode and then joining the two, hot-pressing a membrane with a prepared pastes with the polymer electrolyte and catalyst, applying the electrolyte paste and drying (as applied to claims 54, 56, 57) (para 0227-0229). Sakaguchi et al.'s membrane/electrode assembly also states an inventive property in which both the solid polymer electrolyte membrane and the electrode catalytic layers are preferably mainly composed of the inventive polybenzazole compound having sulfonic/phosphonic acid group (as applied to claim 57) (para 0217). As to steps B) or D), of claims 29, 54, and 57, Sakaguchi et al. mentions that heat can be applied during the reaction and that the optimum temperature depends on the combination of monomers (para 0113, lines 3-4). Additionally, Sakaguchi et al. talks about a drying atmosphere during a heating phase using air or inert gas (para 210, lines 7-9). In a different heating part of the process, Sakaguchi et al.'s reaction is said to be carried out at a high temperature, and the reaction temperature is preferably lowered in the range capable of attaining the effects of the invention (para 0113, lines 7-10). With respect to step F), the polyphosphoric acid moieties of the above membrane are expected to inherently partially hydrolyze (and thus would form the same product as claimed).

Where applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

“In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.” Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

In the case of the instant application the basis for expectation of inherency is the fact that the conditions of Sakaguchi et al. would provide an environment in which polyphosphoric acid hydrolyzes. Examiner points to Example 1 (para 0254-0260) as well as para 0210 to explain the expectation for inherency. As stated in para 0255, the polymer is immersed in water, and in para 0210, it is stated that solidification can be done in air. In both cases (water immersion and air solidification) humidity is available, and with humidity present, the polyphosphoric acid is expected to hydrolyze. Innophos is used as an evidentiary piece to show this characteristic. In the “Validation” section (p2), it is stated that polyphosphoric acid is highly hygroscopic and rapidly absorbs moisture even when only exposed to air (therefore exposure to water would result in water being absorbed as well, as applied to Sakaguchi). Furthermore, Innophos states that once the moisture is absorbed the hydrolysis process begins (“Validation” section on p2). Therefore, since polyphosphoric acid is inherently hygroscopic and starts hydrolyzing upon absorption of water, it is expected that the polyphosphoric acid of Sakaguchi et al. would partially hydrolyze.

The Examiner requires applicant to provide that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product.

Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

For the reasons above, Sakaguchi et al.'s product is the same as the one in the claimed invention. It is noted that the heating temperature and atmosphere mentioned in step B can be varied, as long as the process still produced the proton-conducting polymer membrane comprising of polyazoles containing phosphonic acid groups as claimed in the preamble.

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

"The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742,



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744, 180 USPQ 324, 326 (CCPA 1974). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). Ex parte Gray, 10 USPQ2d 1922 (Bd. Pat. App. & Inter. 1989). See MPEP section 2113.

As to claim 30 and 32, the tetraamino compound in the form of formulas (A) and (C), respectively, is not specifically mentioned. Examples given in para 0093 do not make note of the  $Y_pZ_r$  portion of formula (A) or the  $Y_pZ'_r$  portion of formula (C). However, derivatives can be used as well, and specific examples of the derivatives of the tetraamines that can be used include salts with acids including *phosphoric* and *sulfuric* acid (applied to claims 30 and 32, respectively), which accounts for the Z portion and may include the  $Y_p$  portion as well (para 0094, lines 1-4). Additionally, formulas (A) and (C) are intermediates of the final product mentioned in claim 26. The final product would still include the phosphonic acid group. See MPEP section 2113.

As to claims 31 and 34, an example of the aromatic and or/heteroatomic carboxylic acid is 2,5-dicarboxyphenylphosphonic acid (para 0101, lines 8-9). This example shows the claimed form (B) except for the fact that "p" is zero. However, derivatives of the phosphonic acid can be used (para 0101, lines 10). A carbon chain, as represented by  $Y_p$ , added to the phosphonic acid group would be a derivative of the aforementioned phosphonic acid group. Additionally, this formula (B) is an intermediate

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of the final product mentioned in claim 29.  $Z_r$  is still present in Sakaguchi et al.'s teaching and would be used to form the polymer with the phosphonic acid group. See MPEP section 2113. Additionally the aromatic and/or heteroaromatic tetraaminos given for examples do not have a phosphonic acid group, as can be seen by one compound given as an example: 1,2,4,6-tetraaminobenzene (as applied to claim 34)

As to claim 33 an example of the aromatic and or/heteroatomic carboxylic acid is 2,5-dicarboxyphenylphosphonic acid (para 0101, lines 8-9). The differences between this example and form (D) are (1) "p" is zero and (2)  $Z'_r$  is a phospho group rather than a sulfo group. However, Sakaguchi et al. also mention that dicarboxylic acid having sulfonic acid group and phosphonic acid group may be copolymerized to synthesize the polybenzazole having sulfonic acid group and/or phosphonic acid group, which could represent the  $Y_pZ'_r$  portion of (D) (para 0108). Therefore, Sakaguchi et al.'s aromatic carboxylic acid serves the same purpose as claim 33, which can be applied to the final product mentioned in claim 29. See MPEP section 2113.

Regarding claim 36, Sakaguchi et al. teach a membrane that uses of compounds such as terephthalic acid and 2,2-bis(4-carboxyphenyl-)hexafluoropropane for use of copolymerization for synthesizing polybenzazole (para 0105, lines 1-7, 12, and 15-16).

As to claims 41, 42, and 43, Sakaguchi et al. teaches the use of dicarboxylic acids and Gerber teaches the use of tri and tetra carboxylic acids in the formation of polyazoles. Although specific percentages used for the reaction are not claimed, a certain amount polycarboxylic acid is needed for the reaction to provide the final product. See MPEP section 2113.

As to claim 48, Sakaguchi et al. teaches an inventive resin molding containing the polybenzazole compound having the phosphonic acid group (para 0195). Additionally, the solid polymer electrolyte membrane prepared by mixing a polymer other than the inventive polybenzazole compound having the phosphonic/sulfonic acid group may be employed as the polymer electrolyte membrane (para 0221, lines 1-6). An example of a sulfonated polybenzoxazole compound being mixed with another polymer is shown in example 14, when the compound was later mixed with carbon black, which contains platinum and nafion (para 0305).

As to claim 49, Sakaguchi et al.'s process includes a heating portion after the inventive solution of polybenzazole with the sulfonic acid group is cast on the Teflon or glass plate (para 0210). Such a portion is done with water in the presence of air (both water and air have moisture) (para 0210). The heating portion for drying the sheet is adjustable (para 210, lines 3-2). Although no temperature is specifically given, the end product is the same, and the temperature is adjustable in order to optimize solvent removal and homogeneity of the composite. See MPEP section 2113.

Regarding claim 50, the treatment to get the membrane to be self supporting includes drying out the solvent. Although no specific time period is given by Sakaguchi et al., the speed is adjusted by adjusting the temperature to optimize homogeneity (para 0210). Additionally, thickness would also effect the time. Discovery of optimum of result effective variable in known process is ordinarily within the skill of art. (In re Boesch, 205 USPQ 215 (CCPA 1980).) Selection of optimum ranges within the prior art's general condition is obvious. (In re Aller, 105 USPQ 233(CCPA 1955))

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As to claims 52, 53, and 55, thickness ranges are given at different parts of Sakaguchi et al.'s process. The ranges given for the membrane after the cast is laid is between 10  $\mu\text{m}$  and 1000  $\mu\text{m}$ , preferably between 100  $\mu\text{m}$  and 500  $\mu\text{m}$ , which lies between the range claimed in 52 (para 208). After the membrane is dried, as in step D, the thickness suggested should optimize ion conductivity and mechanical strength. A thickness mentioned that is preferable to both variables is 20  $\mu\text{m}$  (as applied to claim 53) (paras 0211, 0212). The thickness range for the solid polymer electrolyte membrane/electrode assembly, as applied to claim 55, is between 5  $\mu\text{m}$  and 300  $\mu\text{m}$ , preferably between 10  $\mu\text{m}$  and 100  $\mu\text{m}$  (para 0223).

Regarding claims 58, Sakaguchi et al. teach the use of the polymeric material in a solid polymer electrolyte membrane, which is preferably employed in fuel cells (para 0317, lines 1-7).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
6. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of 2001/0003130 (Matsuoka et al.).

The difference between the teachings of Sakaguchi et al. and claim 35 is that none of the compounds 3,3',4,4'-tetraaminobiphenyl, 2,3,5,6-tetraaminopyridine, and/or 1,2,4,5-tetraaminobenzene are taught as being used as a polymeric precursor.

Matsuoka et al. teaches the preparation of polybenzazole and a polybenzazole fiber, which uses 1,2,4,5-tetraaminobenzene as a used to make the polybenzazole polymer (para 0013; para 0015, line 4). Sakaguchi et al. discloses the claimed invention except for using 1,2,5,5-tetraaminobenzene as a polymeric precursor.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

7. Claims 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of JP 2002-146016 (Nakao et al.).

As to claim 37, the difference between Sakaguchi et al. and claim 37 is that Sakaguchi et al. does not mention the use of 2,3-diamino-5-carboxyphenylphosphonic

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acid, 2,3-diamino-6-carboxyphenylphosphonic acid, or 3,4-diamino-6-carboxyphenylphosphonic acid.

Nakao et al. teach an ion-conductive polyazole electrolyte with a phosphonic acid group, wherein carboxyphenylphosphonic acids are precursors used (para 0013). Furthermore, it is embodied that the carboxylic acids may have a two amino groups on it (diamino) (para 0014). Therefore, Nakao teaches the use of diamino-carboxyphenylphosphonic acids thus obviating the use of all diamino-carboxyphenylphosphonic acids (including the ones specifically embodied, barring evidence showing criticality of the claimed diamino-carboxyphenylphosphonic acids over all others). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a diamino-carboxyphenylphosphonic acid as claimed, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claim 38, the difference between Sakaguchi et al. and claim 38 is that Sakaguchi et al. does not mention the use of 2,3-diamino-5-carboxyphenylsulfonic acid, 2,3-diamino-6-carboxyphenylsulfonic acid, or 3,4-diamino-6-carboxyphenylsulfonic acid.

As noted in the rejection of claim 37, Nakao et al. teach an ion-conductive polyazole electrolyte with a phosphonic acid group, wherein diamino-carboxyphenylphosphonic acids are used (para 0013-0014). Since Nakao et al. teach the use of diamino-carboxyphenylphosphonic acids, Nakao et al. obviates the use of all diamino-carboxyphenylphosphonic acids.

However, it is noted that Sakaguchi et al. teach that Sakaguchi et al. teach a polybenzazole with sulfonic acid or phosphonic acid groups, wherein both exhibit excellent processability, durability, solvent resistance, mechanical properties, and ion conductivity that satisfy the object of creating a polymer membrane (para 0022). Therefore, in this case Sakaguchi et al. teach that that phosphonic and sulfonic acid groups have similar properties and achieve the same goals and are thus art recognized equivalents. Therefore, Nakao et al.'s teaching of a diamino-carboxyphenylphosphonic acid obviates all diamino-carboxyphenylsulfonic acids (including the ones specifically embodied, barring evidence showing criticality of the claimed diamino-carboxyphenylsulfonic acids over all others), as it would have been obvious to one of ordinary skill in the art to substitute art equivalents for one another (diamino-carboxyphenylphosphonic acid and diamino-carboxyphenylsulfonic acids). Accordingly, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a diamino-carboxyphenylsulfonic acid (including the ones specifically embodied, barring evidence showing criticality of the claimed diamino-carboxyphenylphosphonic acids over all others) precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claims 39, 40, 44, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of US Patent 3783137 (Gerber).

As to claim 39, the difference between the teachings of Sakaguchi et al. and claim 39 is that the polymeric precursors do not mention the use of aromatic tricarboxylic acids, their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid halides or tetracarboxylic acids, their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid halides.

Gerber teaches a method of producing heterocyclic polymers. This type of polymer includes polybenzimidazole-type compositions (col 2, lines 61-63). It teaches the use of the prepolymer 1,4,5,8-naphthalenetetracarboxylic acid dianhydride, which is an example of a tetracarboxylic acid anhydride as specified by claim 39 (col 13, lines 55-56).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claim 40, the difference between the teachings of Sakaguchi et al. and claim 40 is that the polymeric precursors do not mention the use of 1,3,5-benzenetricarboxylic acid (trimesic acid), 2,4,5-benzenetricarboxylic acid (trimellitic acid), (2-carboxyphenyl)imondiacytic acid, 3,5,3'-biphenyltricarboxylic acid, 2,5,4'-biphenyltricarboxylic acid, 2,4,6-pyridinetricarboxylic acid, benzene-1,2,4,5-tetracarboxylic acid, (naphthalene-1,4,5,8-tetracarboxylic acid, 3,5,3',5'-biphenyltetracarboxylic acid, benzophenonetetracarboxylic acid, 3,3',4,4'-



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biphenyltetracarboxylic acid, 2,2',3,3'-biphenylcarboxylic acid and/or 1,2,5,6-naphthalenetetracarboxylic acid.

Gerber teaches a method of producing heterocyclic polymers. This type of polymer includes polybenzimidazole-type compositions (col 2, lines 61-63). Gerber also teaches that mixtures of tricarboxylic acids may be used as acid derivatives, or mixtures of the acids halides and acid anhydrides may be used in the process of the invention (col 5, lines 60-63). In example 4 of the invention, a heterocyclic prepolymer can be formed using trimellitic (2,4,5-benzenetricarboxylic) anhydride monoacid chloride, which falls under the category as an anhydride derivative of the tricarboxylic acid (col 11, lines 35-37).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claims 44 and 45, the difference between the teachings of Sakaguchi et al. and claims 44 and 45 is that the polymeric precursors do not mention the use of heteroatomic dicarboxylic acids, tricarboxylic acids, and/or tetracarboxylic acids containing at least one nitrogen, oxygen, sulfur, or phosphorous atom in the aromatic, namely pyridine-2,5-dicarboxylic acid, pyridine-3,5-dicarboxylic acid, pyridine-2,6-dicarboxylic acid, pyridine-2,4-dicarboxylic acid, 4-phenyl-2,5-pyridinedicarboxylic acid,

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3,5-pyrazoledicarboxylic acid, 2,6-pyrimidinedicarboxylic acid, 2,5-pyrazinedicarboxylic acid, 2,4,6-pyridinetricarboxylic acid, benzimidazole-5,6-dicarboxylic acid or their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid chlorides.

Gerber teaches the use of diacid halides as a reactant to produced polybenzimidazoles (col 5, lines 15-15). It teaches the use of diacid hydrides derived from 3,5-pyridinedicarboxylic acid and 2,5-pyrazineinedicarboxylic acid.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the aforementioned acids, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

9. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of US 6124060 (Akita et al.).

As to claim 46, Sakaguchi et al. does not teach the use of diaminobenzoic acids or its monohydrochloride and dihydrochloride salts as a polymeric precursor.

Akita et al. teach the use of 3,4-diaminobenzoic acid as a precursor for a polybenzimidazole (col. 4, lines 15-32).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the aforementioned acids, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of

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its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

10. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of WO 01/87992 (Kerres et al.). (Note: US 6,767,585 is being used as an intermediate translation of WO01/87992.)

As to claim 51, Sakaguchi et al. does not teach crosslinking of the polymer. Kerres et al. teaches the use of crosslinked polymers including polyzaoles (polybenzimidazole and polycarbazoles) (col 1, lines 10-11 and 40-41). These polymers membranes additionally may include basic groups, such as sulfonic acid groups and are further used in fuel cells (col 1, line 44-45). Although an oxygen-containing atmosphere for the stated crosslinking is not given, crosslinking is a product-by-process.

The motivation for crosslinking is to provide better mechanical stability, improved modulus of elasticity, higher tensile strength, improved swelling properties in order to be used in fuel cells that can run upward 100°C (column 2, lines 30-38). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Sakaguchi et al. in order to include a crosslinking step to the process since the result would be in strengthening the membrane's mechanical stability, elasticity, tensile strength, and swell properties.

***Response to Arguments***

11. Applicant's arguments with respect to claims 29-58 have been considered but are moot in view of the new ground(s) of rejection.

However, Examiner would like to take some time to address some of the previous arguments addressed to the hydrolyzation of the polyphosphoric acid moieties presented in the arguments received April 17, 2007 in order to clarify the reconsideration of inherency.

Applicant argues that since polyphosphoric acid in Sakaguchi et al. is clearly removed before hydrolysis can occur, since the polymer is precipitated into water and then rinsed.

Examiner respectfully disagrees. In the evidentiary piece, Innophos teaches that polyphosphoric acid has the characteristic of hygroscopy, rapidly absorbs moisture from the air, and hydrolyzes once moisture is absorbed ("Validation" section; p2). Therefore, Examiner sets for the position that during the time that water is introduced to the polyphosphoric acid solvent (and before it is rinsed off) at least some of the polyphosphoric acid hydrolyzes, since Innophos clearly states that polyphosphoric acid readily absorbs moisture and hydrolyzes upon absorbing moisture. Therefore, barring clear proof to the contrary, it is still held that the structure of Sakaguchi et al.'s membrane is the same as the one claimed by Applicant.

Applicant argues that the resulting membrane has distinct, highly advantageous properties over Sakaguchi et al. due to hydrolyzation, wherein such properties can not be achieved by casting the film as in Sakaguchi et al.'s teaching.

Examiner respectfully disagrees. Again Innophos is referred to. It teaches that polyphosphoric acid rapidly absorbs moisture from the air and hydrolyzes once moisture is absorbed ("Validation" section; p2). Therefore, Examiner sets forth the position that during the time that water is introduced to the polyphosphoric acid solvent (and before it is rinsed off) at least some of the polyphosphoric acid hydrolyzes, since Innophos clearly states that polyphosphoric acid readily absorbs moisture and hydrolyzes upon absorbing moisture. Therefore, barring clear proof to the contrary, it is still held that the structure of Sakaguchi et al.'s membrane is the same as the one claimed by Applicant and would accordingly have the same properties that hydrolyzation brings.

Applicant argues that their claimed membrane is designed from use in high temperature fuel cells, whereas Sakaguchi et al.'s membranes show proton conductivity only with humidification (which can only be done at low temperatures).

Examiner respectfully disagrees with Applicant's view on Sakaguchi et al. Although the test conditions of Sakaguchi et al. are drawn to low temperature and high humidity, this does not necessarily mean that Sakaguchi et al. would not function in the same manner as Applicant's membrane (in high temperature fuel cells). As it is held to be structurally the same as the instant application, it would inherently function in the same manner in the same conditions. Applicant has not provided any positive proof that the claimed invention and Sakaguchi et al. are different and would not operate the same under the same conditions, and thus the rejection is upheld.

Applicant argues specifically with respect to Kerres that the addition of cross-linking in Sakaguchi et al.'s membrane would not result in the claimed membrane, as

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Sakaguchi et al.'s membrane requires humidity to function and has no conductivity above 100°C.

Examiner respectfully disagrees with Applicant's position. Just because Sakaguchi et al. has test condition that have low temperature and high humidity does not necessarily mean that it is incapable of functioning at high temperatures and without humidity. As it is held to be structurally the same as the instant application, it would inherently function in the same manner in the same conditions. Applicant has not provided any positive proof that the claimed invention and Sakaguchi et al. are different and would not operate the same under the same conditions, and thus the rejection (Sakaguchi et al. in combination with Kerres) is upheld.

Applicant argues that Sakaguchi et al. teaches away from hydrolyzed polyphosphoric acid moieties.

Examiner respectfully disagrees. Sakaguchi et al. does not make a statement as to the fact that hydrolysis does not occur or that hydrolysis is unfavorable. Therefore, no teaching away from hydrolyzation exists. Furthermore, hydrolyzing of the polyphosphoric acid moieties is seen to be inherent as set forth in the rejection using the "Validation" section of Innophos (p2) (see also the rejection of claims 29, 54, and 57). Therefore, barring clear proof to the contrary, the rejection is upheld.

With respect to the prior art used, Applicant argues that there is no motivation to partially hydrolyze the polyphosphoric acid moieties of the polymer to get a membrane with the enhanced physical and conductive properties of the claimed invention.

Examiner respectfully disagrees. Applicant has not provided proof that that the combined prior art references do not yield the claimed invention. Furthermore, hydrolyzing of the polyphosphoric acid moieties is seen to be inherent as set forth in the rejection using the "Validation" section of Innophos (p2) (see also the rejection of claims 29, 54, and 57). Applicant has not provided any proof as to the fact that the claimed membrane is different than that of the prior art or that hydrolyzation positively does not occur. Therefore, all of the properties inherent to a membrane subjected to hydrolyzation of polyphosphoric acid would also be inherent. There is no requirement that a person of ordinary skill in the art would have recognized the inherent disclosure at the time of invention, but only that the subject matter is in fact inherent in the prior art reference. *Schering Corp. v. Geneva Pharm. Inc.*, 339 F.3d 1373, 1377, 67.

With respect to the arguments regarding the 103 other rejections, Applicant argues that the prior art used to obviate the rejected claims (Matsuoka, Gerber, Kerres) do not cure the deficiencies of the primary reference (Sakaguchi). Applicant does not argue how the combination is not proper. Therefore, the Examiner maintains the obviousness rejections and upholds the rejection of the primary reference, as above.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EUGENIA WANG whose telephone number is (571)272-4942. The examiner can normally be reached on 7 - 4:30 Mon. - Thurs., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/E. W./  
Examiner, Art Unit 1795

/Gregg Cantelmo/  
for E. Wang, Examiner of Art Unit 1795